Yucca Mountain Site Characterization Project

RECLAMATION IMPLEMENTATION PLAN

YMP/91-14

Revision 1

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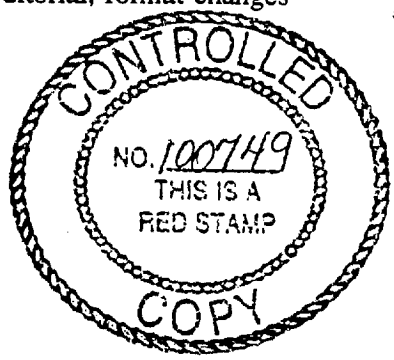

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FOREWORD

This Yucca Mountain Site Characterization Project (YMP) Reclamation Implementation Plan (RIP) has been approved by the Yucca Mountain Site Characterization Office (YMSCO) for implementation by the YMSCO and all Affected Organizations.

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1.0 INTRODUCTION

The United States plans to begin operating the first repository for the permanent disposal of high-level nuclear waste early in the next century. The Nuclear Waste Policy Act of 1982, as amended (NWPA), specifies the process for siting, constructing, operating, closing, and decommissioning a repository. This legislation directed the U.S. Department of Energy (DOE) to characterize the Yucca Mountain site for possible development of the first nuclear waste repository. During the site characterization phase, the DOE will construct an Exploratory Studies Facility (ESF) for underground testing to determine whether geologic and hydrologic conditions at the site will safely support construction and operation of a repository. Examples of surface-disturbing activities include drilling, trenching, and road building and clearing.

It is the policy of the DOE to conduct its activities in an environmentally safe and sound manner. To accomplish this commitment, the DOE has established an environmental program for the Yucca Mountain site that plans and performs the activities necessary to satisfy applicable environmental regulatory and programmatic requirements. The environmental program is structured to satisfy the statutory requirements of the NWPA, the National Environmental Policy Act, the Atomic Energy Act, other applicable statutes, regulations, DOE Orders, and Bureau of Land Management (BLM) Right-of-Way Agreements. The environmental program is integrated with other programs under the direction of the DOE Office of Civilian Radioactive Waste Management to evaluate the Yucca Mountain site as a candidate site for a repository. Office of Civilian Radioactive Waste Management environmental programmatic policy requirements (as described in the Mission Plan, as amended) also have been incorporated into the environmental program.

1.1 OBJECTIVES

Section 113(b)(1)(A) of the NWPA specifically requires the DOE to prepare plans for decommissioning, decontamination, and reclamation of areas disturbed by site characterization activities. As a result, the DOE has prepared a series of management plans that define the DOE policy toward reclamation of disturbed areas, describe the implementation of that policy at the field office level, and define the methodology whereby information will be gathered in the conduct of DOE studies.

The Draft *Reclamation Program Plan* (RPP) *for Site-Characterization Activities* is the first in this series of documents, and was written to define the reclamation policy of the DOE for the Yucca Mountain site, and to present an overview of the reclamation program for that site with respect to programmatic requirements. Policy issues discussed in the RPP include reclamation objectives, consistency of reclamation practices across the Yucca Mountain site, and timing of reclamation.

This RIP for the YMP has been written in response to the policy statement provided in the RPP, and describes the steps to be taken in implementing that policy. This document was written for use at the YMSCO level. The *Environmental Management Plan*, YMP/93-04, is the higher level plan in the YMP document hierarchy that dictates the flow down of requirements to this RIP.

The Draft *Yucca Mountain Project Reclamation Feasibility Plan* (RFP) was written to describe studies that will be used to determine the feasibility and effectiveness of various revegetation techniques at Yucca Mountain. The results of these studies will be used in developing reclamation specifications.

Reclamation is defined as "those activities employed to return land disturbed by site-characterization activities to some predetermined condition." Reclamation includes decommissioning of disturbed areas (where appropriate), and steps to stabilize soils and establish an acceptable vegetative cover. Decommissioning (the placement of facilities developed during site characterization in a permanently nonoperable, safe condition) will be required at many locations.

1.2 PURPOSE AND SCOPE

The need for determining and implementing a policy toward reclamation of areas disturbed as a result of site characterization activities is recognized by the YMP. It is the purpose of this RIP to document how the programmatic policy toward reclamation described in the RPP will be implemented at the operations level of the YMP and to establish requirements for surveys and analysis of selected areas of the Yucca Mountain site so that reclamation may be planned prior to the disturbing activity.

Reclamation guidelines have been developed, based on established reclamation methodologies for arid ecosystems, so that an acceptable level of reclamation success will result when implemented. Some of the successes of those methodologies are summarized in Section 1.4. The programmatic and environmental requirements for site characterization activities at Yucca Mountain, and the DOE's approach for complying with those requirements, as described in the RPP, also have been taken into consideration.

Chapter 2.0 of this RIP explains the guidelines that also have been established for monitoring reclamation success. Chapter 3.0 of this RIP explains which reclamation guidelines will be implemented for each different type of site characterization field activity, and how individual site specific guidelines will be determined. Chapter 4.0 describes how the site-specific reclamation specifications are identified and implemented.

As a tenet of the land access agreement between the BLM and the DOE in the right-of-way reservation for the conduct of site characterization activities, the DOE committed to restore all disturbed areas to their original use and condition, to the extent practicable. In addition, the DOE is obligated to review all proposed reclamation plans with the BLM.

1.3 DESCRIPTION OF THE PROJECT AREA

The *Site Characterization Plan* (SCP), DOE/RW-0199, has categorized activities that will be conducted to support investigations of Yucca Mountain as a potential site for a high-level radioactive waste repository as either site investigations or regional investigations. The SCP defines the boundaries of the site area on the basis of geologic structural considerations. These boundaries consist of Prow Pass to the north, Fortymile Wash to the east, a northeast-trending lateral fault south of Busted Butte to the south, and the Windy Wash fault zone to the west. This site area roughly corresponds to the rectangular site area depicted in Figure 1-1. Activities that occur outside the site area are considered regional investigations.

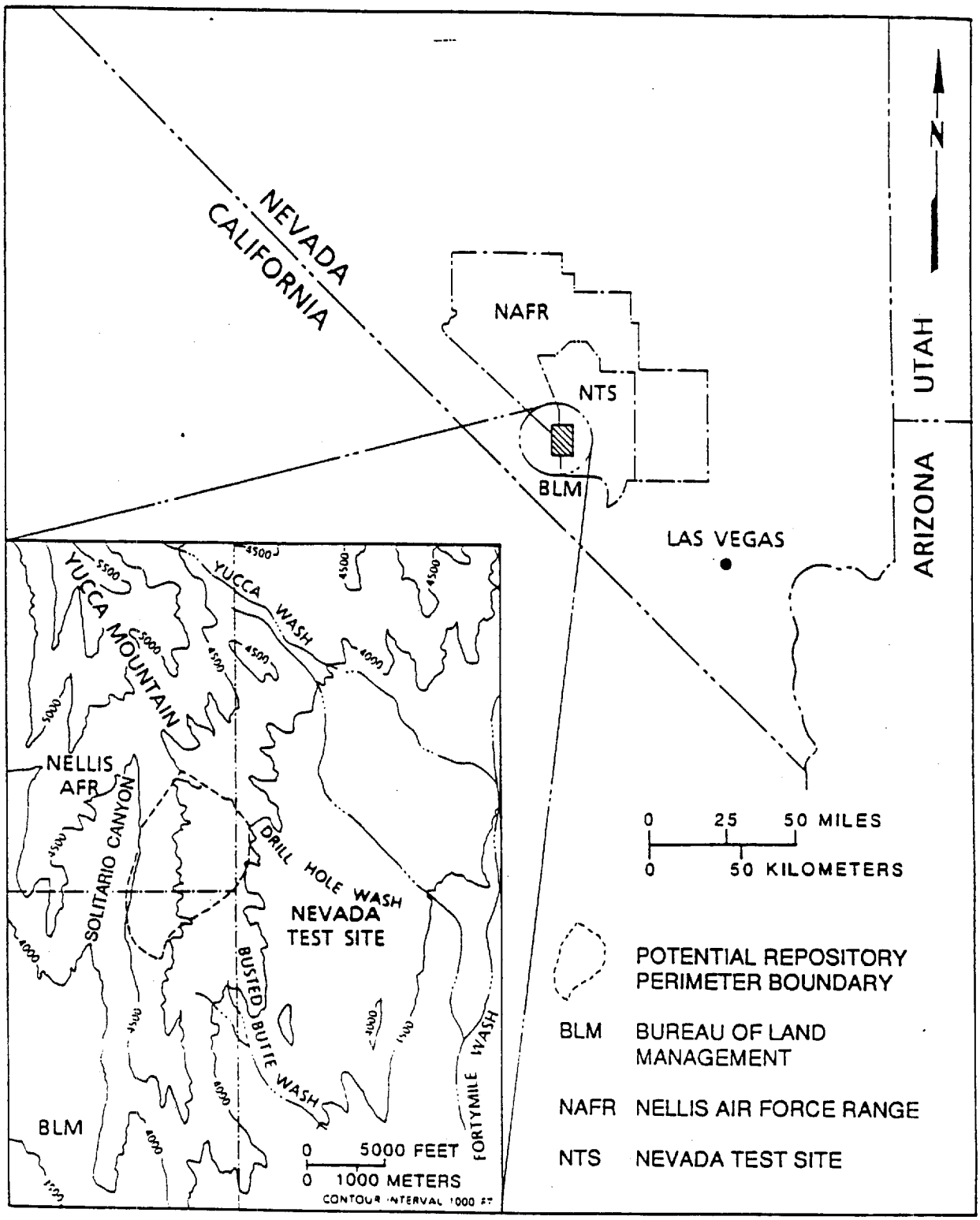

Figure 1-1 Approximate Location of Yucca Mountain Site Area, based on SCP Definition of Geologic Structural Considerations

The YMP area consists of any area where site characterization field investigations occur, including both site and regional investigations. However, for the purposes of this RIP, the YMP area includes only those field-investigation sites that create surface disturbances that would require the implementation of reclamation activities described herein. The majority of surface disturbing activities will occur within the site boundaries. However, if other activities are implemented that result in surface disturbance, these areas also will be reclaimed.

The YMP area is located in southwestern Nevada, approximately 26 km (16 mi) north of the community of Amargosa Valley (formerly Lathrop Wells), Nevada. The site area is located exclusively within lands controlled by the federal government. Administration and use of the site area is divided among three federal entities: DOE, U.S. Air Force, and the BLM. The DOE administers and uses the eastern portion of the site through land withdrawn for use as the Nevada Test Site (NTS). The U.S. Air Force uses the northwestern portion of the site through land withdrawn for the Nellis Air Force Range, the surface of which is administered by the BLM. The BLM administers the southwestern portion of the site as public trust lands.

The YMP area lies within the arid basin and range geographical region. According to the *Environmental Field Activity Plan* (EFAP) *for Air Quality*, YMP/91-42, the climate of the YMP area is characterized by strong solar insolation, limited precipitation, low relative humidity, and large diurnal temperature ranges. The overall weather patterns are influenced primarily by continental air masses, which contain only limited amounts of moisture. The average annual precipitation at a weather station at Yucca Flat, located approximately 32 km (20 mi) east of Yucca Mountain on the NTS, from 1962-1971 was 14.55 cm (5.73 in).

The geology of the area is made up of late Miocene and early Pliocene volcanics whose topographic and structural effects partly cover the typical basin and range topography of the region. Soils are generally thin in most highland areas, while thick sequences of Quaternary alluvium fill the valleys. Soils and sediments are generally derived from volcanic rocks (primarily volcanic tuffs). The soils generally have coarse to medium textures and are modified by rock fragments (dominantly gravels and cobbles). Most of the soils are calcareous and it is common to find calcic horizons either near the surface or as buried soil horizons. They are moderately to strongly alkaline (pH ranging from 8.0 to 8.6). Additional information on the soils of the YMP area is presented in the Draft *EFAP for Soils*, YMP/90-11.

The *EFAP for Terrestrial Ecosystems*, YMP/91-41, describes two major floristic zones that occur within the YMP area: (1) the Mojave Desert, a warm desert occurring below 1220 m (3900 ft); and (2) a transition zone, often called the Transition Desert, which extends in a broad east-west corridor between the Mojave and the cooler and wetter Great Basin Desert (located north of the YMP area at elevations above 1525m (4900 ft). Within these two zones, four major vegetation associations occur: Larrea-Ambrosia (Creosote Bush-Bursage), Larrea-Lycium-Gravia (Creosote Bush-Boxthorn-Hopsage), Lycium-Gravia (Boxthorn-Hopsage) and Coleogyne (Blackbrush). Each association is actually a mosaic of subassociations consisting of dominant, codominant, and less abundant species of shrubs, grasses, and forbs.

1.4 PREVIOUS RECLAMATION RESEARCH

Natural succession on disturbed arid-lands is a very slow process. Experience at the NTS indicates that decades of time are necessary for the vegetation in disturbed areas to return to its original state (Romney, Wallace, and Childress, 1971). However, several studies have demonstrated that, through implementation of reclamation practices, habitat restoration of disturbed lands in arid ecosystems (including the Mojave Desert) is potentially achievable. The following paragraphs summarize some of the past research that has been conducted for habitat restoration of arid lands.

Revegetation and planting trails conducted in the early 1970s demonstrated success with planting fourwing saltbush (Atriplex canescens) onto disturbed lands in the southwestern desert (Aldon, 1972; Cable, 1972; Springfield, 1970).

In an attempt to determine the effects of grazing by rodents on revegetated plant communities, 14 species of native shrubs were transplanted to bare areas in a natural Mojave desert shrub community on Frenchman Flat of the NTS. Some of these plants were fenced to prevent grazing while others were not. Each plant received supplemental watering monthly through the summer (10 to 20 liters of water per plant per month). Survival rates six years later were 42 percent for fenced shrubs and 23 percent for unfenced shrubs (Hunter, Wallace, and Romney, 1980).

The California Department of Transportation has had success transplanting in the Mojave Desert in areas receiving from 10-18 cm (4-7 in) of annual precipitation (Clary, 1983). In revegetation efforts conducted by the California Department of Transportation, several species indigenous to the Yucca Mountain region were successfully established on disturbed lands. These species included creosote bush (Larrea tridentata), California buckwheat (Eriogonum californicum), and desert saltbush (Atriplex polycarpa), as well as other species. Although direct seeding did not meet with as much success as transplants in these efforts, it was felt that seeding could be used as a minor component of a revegetation effort (Ostler and Allred, 1987). Roadside revegetation north of Bishop, Calif., on a volcanic tuff site that was considered to have problem soil and planting conditions (attributed to the sterile soil material left as a result of road disturbance) had poor results from direct seedings. However, container plantings had good survival rates (Clary, 1983).

Habitat restoration efforts conducted in 1985 and 1986 on the Elk Hills Naval Petroleum Reserve #1, located in Kern County, Calif., have had fair to good success. Disturbed sites there were seeded by drill seeding or hydroseeding (EG&G/EM, 1987). The type of disturbances at Elk Hills are similar to those anticipated for the YMP (i.e., drill pads, access roads, and cut-and-fill slopes), although the amount and distribution of precipitation is more favorable at Elk Hills.

Past research also demonstrates that interim reclamation practices, including actions implemented prior to and during surface disturbing activities, and site preparatory actions implemented during final reclamation, will enhance reclamation efforts. These established reclamation practices are summarized in the following paragraphs.

Determining predisturbance site characteristics, which will be done during the conduct of preactivity surveys, assists the reclamation specialist in defining reclamation goals, selecting the proper species that are adaptable to the site, and in providing a basis for which

reclamation success can be measured (U.S. Department of Agriculture [USDA] Forest Service, 1979; Thornburg and Fuchs, 1978; Packer and Aldon, 1978; Holmberg, 1983). The salvage and proper management of native soil materials in desert ecosystems is critical to the overall success of the reclamation process (Ostler and Allred, 1987; and Wallace, 1980).

Erosion control measures including proper design, construction and maintenance of drainage controls are important to overall reclamation success because of the protection of valuable soil resources. They also will minimize impacts to the predisturbance hydrological conditions of the site (Verma and Thames, 1978). Control of fugitive dust resulting from wind erosion, as a result of land disturbing activities, is a regulatory requirement for the YMP (Clean Air Act, as amended, Public Law 95-95, and Nevada Regulatory Statutes 445.401 et seq.).

Recontoured slopes need to be stabilized prior to revegetation work to ensure that a proper seed bed is provided (Wallace, 1980). The topography should be aesthetically pleasing, and blend with the surrounding undisturbed terrain. The surface needs to be satisfactory for applying soil material suitable for plant growth, which may require roughening, through ripping or chiseling, to permit better fusion and stability with surface materials (Thornburg, 1982). Recontouring of disturbed sites needs to be done to the extent that predisturbance drainage conditions are restored and the hydrologic balance of the site is protected (Stiefel and Busch, 1983).

Wallace (1980) presents three general "rules-of-thumb" arid land reclamation specialists usually agree are needed when revegetating disturbed sites such as fill-slopes and compacted surfaces of old roadways and other facilities. These are: (1) stabilize soils, if necessary, before planting (as discussed previously); (2) preparation of a good seedbed with a micro-topography that will "harvest" water as well as hold seed; and (3) use of native or naturalized plant materials. USDA Forest Service General Technical Report INT-64 (USDA, 1979a) and several of the researchers referenced therein also discuss the need for good seedbed preparation and proper selection of plant materials. Part of seedbed preparation may require amending soils materials, such as incorporating organic or chemical fertilizers. Wallace and Romney (1980) noted the presence of fertile areas high in soil organic and available nutrients beneath shrub clumps in the northern Mojave Desert. These clumps occupy about 10 to 20 percent of the surface area. They felt that if this small amount of fertile soil is uniformly distributed throughout the entire area, nitrogen deficiency conditions could result. The use of mulches following revegetation efforts may be needed to prevent erosion, facilitate infiltration, inhibit evaporation, and provide better soil temperatures for plant growth (USDA, 1979a).

The reclamation guidelines, discussed in Chapter 2.0 of this RIP, have incorporated each of these common practices. Chapter 3.0 states which of these practices will be implemented, based on the general categories of site characterization field activities.

1.5 RECLAMATION INFORMATION NEEDS

Although some technical field information exists regarding how to reclaim disturbed habitats, additional investigations are needed to determine the applicability and feasibility of several reclamation practices, especially those dealing with site-specific methods and materials to be used to revegetate disturbed sites.

These additional information needs have been identified in the RFP, and include: studies of natural succession on disturbed areas, studies to determine the effects of stockpiling soil materials over long periods, mined spoil revegetation studies, and reclamation trial studies. The impact of grazing by rodents also will be examined during the conduct of the reclamation trial studies. In addition to these field studies, a literature review will be conducted to provide a comprehensive listing of reclamation and ecosystem research directly and indirectly related to the YMP area.

The results of RFP investigations will be used to revise, as necessary, the methods, techniques and specifications discussed in this RIP. The results of the disturbed habitat studies and the reclamation trial studies will enable species lists to be developed and incorporated into this RIP for both interim and final revegetation efforts. The results for the reclamation trial studies will be used to determine the most appropriate planting technique, or combination of techniques to be implemented (i.e., direct seeding, transplanting, or combination). Until this additional site-specific data is available, the implementation of revegetation efforts will rely on the technical judgment of the reclamation specialist. The specialist will use information from past efforts on the NTS, guidelines from this RIP, informatibn from the EFAP and information obtained by other reclamation specialists working in similar habitats (some of which were summarized in the previous section). The ongoing literature review, described in the RFP, also will aid the reclamation specialist in determining revegetation techniques and identifying plant materials in lieu of site-specific data.

The information obtained from results of the mined spoil investigations will identify any additional amendments or other requirements that need to be incorporated into the reclamation guideline for surface disposal of underground development waste. Any additional requirements that may be needed for this guideline would not be needed until near the end of the site characterization phase, which should allow sufficient time to complete the study and amend this RIP as necessary.

2.0 RECLAMATION GUIDELINES

The actions presented in this chapter will serve as YMP guidelines for reclamation. They are presented as general reclamation activities, techniques, methods, and specifications that shall be considered for implementation in order to meet the YMP reclamation goals as defined in the RPP, and summarized previously in Section 1.2. Chapter 3.0 of this RIP explains which guideline will be implemented for each different type of field activity.

The following discussion of each general guideline provides a definition of what is meant by that guideline, and a description of the actions that will be considered for implementing the guideline. Previous research used in developing these guidelines were summarized in Section 1.4. These guidelines cover the three phases of reclamation, which are defined in the RPP. The three phases include interim reclamation, final reclamation, and post reclamation monitoring.

2.1 PREACTIVITY SURVEYS

A preactivity survey is the process of assessing or inventorying the biotic and edaphic resources of an area prior to any disturbance of that area. Preactivity surveys are described in detail in the *EFAP for Terrestrial Ecosystems*, YMP/91-41, and the Draft *EFAP for Soils*. Preactivity surveys for archaeological resources also will be conducted prior to surface disturbance, as described in the *EFAP for Archaeological Resources*, YMP/92-15. However, the monitoring and mitigation of archaeological resources is not considered a component of reclamation and will not be discussed herein. Mitigation of archaeological resources, although not a component of reclamation, will be coordinated with reclamation activities, as necessary.

The preactivity survey has four basic objectives for reclamation:

1. To determine the presence and amount of soil and vegetative resources that are suitable for salvage and use in reclamation of disturbed areas.

2. To document current vegetation on the area to be disturbed.

3. To determine if important species (endangered or threatened species) occur on the area to be disturbed.

4. To assess the importance of the area as wildlife habitat.

The information collected during preactivity surveys will assist the reclamation specialist in developing appropriate site-specific reclamation requirements, and may assist in determining success of reclamation efforts. Photographs of the area will be taken prior to disturbance to document vegetation present and aid in assessing status following revegetation. The preactivity survey of the area to be disturbed also will provide information to assist in siting field activities to avoid or minimize environmental impacts (e.g., advising against locating an activity in an ephemeral drainage).

An attempt will be made to conduct preactivity surveys at suitable periods during the year to allow for an adequate assessment of the resources (e.g., during the spring, which is the time of active vegetative growth). Regardless of time of year, site inventories will be scheduled

far enough in advance of any activity to allow for an adequate assessment of resources, for completion of laboratory analyses of soil samples that may be taken, for reporting of findings, and for modification of an activity if required. Normally, the minimum lead time for conducting a preactivity survey is three months.

The preactivity survey will assist in determining what measures should be taken prior to site disturbance and construction activities to minimize impact to natural resources and to facilitate later reclamation efforts. These components are summarized in the following sections.

2.1.1 Soils

An adequate soil cover is essential to the establishment of vegetation in desert areas (Ostler and Allred, 1987; Wallace, 1984). Due to the limited amount of topsoil (A horizon soils) in arid ecosystems, it may be necessary to use suitable subsoils (B and C horizons) as a topsoil substitute (USDA, 1979a). Therefore, an assessment of suitability and depth of soil materials will be made at each activity location proposed for site preparation. Details of the soil sampling and suitability analysis can be found in the Draft *EFAP for Soils*.

Soil properties and the range of limits for those properties will be used to determine the suitability of soils for reclamation purposes. An example of the types of soil properties to be evaluated may be found in Table 3.1-3 of the Draft *EFAP for Soils*. These properties and limits will be determined by laboratory analysis of soil samples collected from each site. From this sampling and analysis, a topsoil removal plan (including maps if necessary) will be developed that identifies required grading levels, contour lines, and depths for soil stripping and salvage. This information will be provided to the construction engineer as input to site preparation.

In addition to the analysis conducted to determine suitability, soil profiles will be described at selected sites, and additional physical and chemical soil properties will be determined. This additional field and laboratory analysis will assist the reclamation specialist in formulating site-specific reclamation requirements, particularly those dealing with selection of appropriate plant materials and management of stockpiled soil.

2.1.2 Vegetation

An assessment of the vegetation that occurs at each site also will be conducted prior to any surface disturbance. This assessment is described in the *EFAP for Terrestrial Ecosystems*. Information gathered will include determinations of vegetation association, dominant species and their relative abundance, and weed presence. This assessment will provide the reclamation specialist with predisturbance information that will assist in selecting appropriate plant species for revegetation, and assist in developing success standards for the reclamation program.

During site clearing, vegetation that can be removed from the site, for transplanting (described in Section 2.2), will be specified and marked. Because of the lack of root pruning under natural conditions, success from salvaging deep rooted shrubs and trees may be very

limited. Joshua trees (Yucca brevifolia) and cacti (Cactaceae) are the most suitable species for transplanting because they have adventitious root systems which generally adjust well to transplanting.

2.1.3 Important Species and their Habitats

A survey for important species will be conducted at each site proposed for surface disturbing activities, as described in the *EFAP for Terrestrial Ecosystems*. Important species, as defined by the U.S. Nuclear Regulatory Commission, are any species of commercial or recreational value, species classified as threatened or endangered, candidates for federal classification as threatened or endangered, other species protected by federal or state law or regulation, and species that affect the well-being of other important species. The important species which occur or potentially occur at the Yucca Mountain site are listed in Table 1.3-1 of the *EFAP for Terrestrial Ecosystems*. Among these important species is the desert tortoise (Gopherus agassizii) which received emergency listing as an endangered species by the U.S. Fish and Wildlife Service in the August 4, 1989 Federal Register (54 FR 32326) and has since been classified by the U.S. Fish and Wildlife Service as threatened (55 FR 12178). If any important species are found in areas proposed for disturbance, avoidance or other mitigation measures shall be considered for implementation. In addition to determining if important species are actually present at a site to be disturbed, an assessment will be made to determine if the area provides habitats for important species. Examples of important habitat would include desert tortoise cover sites and kit fox dens.

2.2 SITE CLEARING

Site clearing is the process of removal from an area to be disturbed, salvage, and storage of vegetation, soils, or other valuable biological resources that could be used in reclamation. The extent of the site clearing that will be required for each specific disturbance will be delineated through the results of the preactivity survey process. Vegetation may not be saved at all sites; however, any vegetation that will be saved will be marked or otherwise identified, and instruction given on its handling and removal. The topsoil stripping plan, generated as a result of the site inventory conducted during the preactivity survey, will contain details on depths of soil to be removed, placement, and/or storage.

Various methods and types of equipment have been developed specifically for clearing vegetation and soil resources for land reclamation (USDA, 1979b and Long et. al., 1984). Since the overall amount of site preparation that will be required during site characterization is relatively small (as compared to a strip-mining project), and the types of disturbances consist of several small sites (i.e., drill pads and trenches) and access roads, specialized site clearing equipment will not be used. Rather, typical earth moving equipment, such as bulldozers, front-end loaders, dump trucks, scrapers and graders will be the primary equipment used for vegetation and soil removal. The particular method(s) selected for a particular disturbance will be based on the size and type of disturbance, physiographic location, the type and density of vegetation present, amount of topsoil present, and the location of the topsoil stockpile. The following are suitable methods for removal of vegetation and soil.

2.2.1 Vegetation Removal

Vegetation that is identified during the preactivity survey process as being suitable for removal and transplanting elsewhere will be removed first. Small trees or shrubs can be removed with a tree spade for subsequent reuse. Although not as successful as a tree spade, front-end loaders have been used for transplanting mature vegetation (Crofts and Parkin, 1979). The process of removing and salvaging vegetation for planting elsewhere is not only dependent on availability of suitable vegetation, but also will be dependent on having a location where the vegetation can be transplanted at the time of removal. Since the majority of disturbances will, out of necessity, remain disturbed over a fairly long period of time, the use of this method may be limited. The potential for using transplanting will be investigated as part of reclamation trial studies described in the RFP.

Vegetation not salvaged for replanting and boulders that would impede soil salvage efforts need to be removed prior to stripping soil. This can be accomplished using a bulldozer and/or a brush rake (NPI Reclamation Services, 1985). Where possible, shrubs, grasses, and forbs will be incorporated or mulched into the soil. This is best accomplished by chopping or shredding vegetation. If equipment for chopping or shredding is not available, woody vegetation will be removed and not mixed into the soil.

If site preparation does not include perturbation of the soil, but would require the removal of vegetation, vegetation will be cut and cleared by hand from a site with no additional disturbance of the soil or removal of the topsoil. An example of such an activity was the effort for orthophoto-mapping; the setting of triangulation points required only vegetation removal. By minimizing the disturbance of vegetation roots and soil resources during construction, many native plant species can re-establish more quickly from reserve seed and root materials remaining in the soil.

2.2.2 Soil Removal

Following vegetation removal, the site is ready for removal of all suitable soil materials that are deemed necessary for reclamation of the site and that could provide a favorable medium for plant growth. The method of topsoil removal will depend on the volume of material, where the materials will be moved to, and the type of stockpile, if applicable. Where possible, the topsoil will be stored adjacent to the site of disturbance. In this case bulldozers would be the more practicable method of removal. Scrapers can generally move soil more efficiently than bulldozers if haul distances are long (e.g., > 200 m [700 ft]), and areas of disturbance are large (Skelly and Loy Engineering Consultants, 1975).

2.3 TOPSOIL STORAGE AND MANAGEMENT

For the YMP, topsoil is defined as any soil (including subsoil) that is deemed suitable as a growth medium for vegetation. Specific criteria for classification of suitability was given in Table 2.1.1-1. Topsoil that is removed from a disturbed site must be protected from erosion and biological degradation if it is to retain its utility for reclamation (USDA Forest Service, 1979b). Storage techniques, stockpile depth, erosion protection, and timing of stockpiling are important parameters in maintaining a viable topsoil (Miller, 1984; Ostler and Allred, 1987; Wallace, 1984).

Topsoil management is a broad term that includes topsoil evaluations, stripping plans, redistribution plans, and soil preparation for revegetation. These aspects of topsoil management are discussed under other guidelines (site inventory, site clearing, and revegetation). The methods included in this section are specifically aimed at topsoil handling and protection to retain its maximum utility. The two methods of topsoil handling include (1) direct lifting and replacement of topsoil, and (2) topsoil stockpiling. These methods are discussed below.

2.3.1 Direct Lifting and Replacement of Topsoil

This involves the removal of topsoil from one site with direct replacement at a different location. This is the preferred method of topsoil handling because fresh topsoil contains live seeds and plants that will take root and aid in stabilizing the site (USDA, 1979b). Therefore, the soil resource does not lose its viability and nutrients as compared to stored soils. The applicability of this method for site characterization is limited because another site with similar physiographic, edaphic, and biotic properties must be available for acceptance of the transferred soil.

2.3.2 Topsoil Stockpiling

Physical or chemical treatments, such as chemical binding polymers or mulch, may be applied to protect the topsoil stockpiles from erosion by water and wind where short-term storage of topsoil (from one to six months) is anticipated (USDA, 1979b; Ostler and Allred, 1987). Periodic spraying with water should not be used as a method for controlling dust on the topsoil since it may cause seed and spore germination, and may enhance decomposition of organic matter and mineralization of nutrients.

Long-term topsoil storage (greater than six months) should be stabilized through grading and mulching combined with the establishment of a vegetative cover (USDA, 1979b). This vegetative cover can act as an erosion control measure, provided adequate cover is maintained to protect the soil from water and wind, as well as providing a source of organic material during the time the soil material is stockpiled. Species should be used that provide a quick cover, are mycorrhizal, and do not have to be replanted each year. Optimal treatments and seed mixtures to preserve topsoil in arid environments are being investigated as part of the studies described in the RFP.

The topsoil stockpile will be located such that potential for erosion and disturbance is minimized. It may be necessary to place a berm, a ditch, or both around the base of a stockpile to protect it from disturbances and prevent loss of soil material from erosion due to runoff. The design or shape of the topsoil stockpiles will be determined for each site based on the location, size of disturbance, amount of topsoil salvaged, available space, potential for erosion, and the length of time the topsoil will be stored.

2.4 EROSION CONTROL

Soil erosion can be considered as a two-step process: (1) detachment, or the breaking away of individual soil particles or small aggregates at the surface; and (2) transportation, which results in the actual loss of soil material from the site. Wind and moving water provide energy for particle detachment and transportation. Therefore, this erosion control guideline for the YMP will consider both of these agents.

Since erosion is an active natural process, it is not the intent of erosion control practices to eliminate erosion from those areas impacted by surface based activities, but rather to control and thus minimize erosion during site characterization and site decommissioning. A number of treatments are applicable for erosion control on disturbed lands of arid regions (USDA, 1976b; NPI Reclamation Services, 1985). Minor grading and shaping modification of disturbed areas and recontoured sites (discussed later in Section 2.7), which promote on-site conservation of precipitation, will be used in combination with erosion control treatments discussed herein. Also, surface disturbances will be limited to the smallest practicable area needed to conduct the planned activity. Siting and construction of roads will be done to control runoff and erosion to the maximum extent practical. This combination should be effective in protecting valuable soil resources from erosion, help in the establishment of vegetation, and minimize disturbances to the hydrologic balance of the site (Verma and Thames, 1978). Erosion control measures to be implemented at Yucca Mountain consist of the following standard biological, physical, and chemical treatments.

2.4.1 Biological Treatments

Stands of temporary vegetation will be established on areas that are not subject to continued use. Vegetation species for this use would be similar to those for stabilizing topsoil stockpiles, and as such, will be evaluated as part of the RFP investigations.

2.4.2 Physical Treatments

Areas that are disturbed as a result of grading and/or cut-and-fill operations, and sites that have been recontoured shall be stabilized through landshaping, including controlling slope angles, stabilizing fill slopes by compaction to acceptable safety factors and scarification of the surface. The slope angles discussed in this, and other sections of this RIP, are based on recommendations from the various sources referenced in Section 5, including USDA, 1975; USDA, 1979b; 30 Code of Federal Regulations) CFR; and State of Utah, 1982.

Maximum slope angles should be no steeper than one and a-half horizontal to one vertical (1.5h:1v) for cut slopes in unconsolidated materials; 0.25h:1v in rock; and 2h:1v for fill slopes, unless the embankment is a minimum of 85 percent rock, in which case they should not be steeper than 1.5h:1v. However, recommended slope angles for revegetation considerations are 4h:1v to 3h:1v. Surface scarification techniques, which will create microtopographic features that will promote moisture retention and reduce the rate and volume of runoff, include pitting and gouging. Runoff upslope from disturbed areas will be diverted away from disturbed areas in a controlled manner through the use of diversion channels and berms. Drainage channels will be lined and/or energy dissipation structures provided, consisting of rock or vegetation, where necessary to limit erosion or stream channel scouring. Straw dikes, rip-rap, check-dams, water bars, vegetative sediment filters, and other measures will be emplaced as necessary to reduce overland flow velocity, reduce runoff volume, or trap sediment. Mulching practices are well known for their effective but temporary role in soil and water conservation on disturbed areas (Verma and Thames, 1978). Mulches provide protection for the soil surface against erosion, retard evaporation, and increase infiltration of precipitation. The use of mulches, and determination of what type of mulch is most effective for the Yucca Mountain area will be evaluated as part of the RFP investigations.

2.4.3 Chemical Treatments

Reducing dust and soil blowing from use areas will be accomplished by paving or spraying surfaces with water and possibly soil binding agents. Specific treatments will be implemented at the time of site preparation, and will continue until such time that successful reclamation of affected areas can be achieved. The practice or combination of practices to be implemented are site-specific and depend on the type of activity (i.e., drill pad, trench, ESF area, etc.), the type of surface preparation required, and the location of the site. Routine maintenance, including grading and spraying, will be conducted as needed to control erosion. Dust-control water may be "tagged" with a conservative tracer.

2.5 DRAINAGE CONTROL

Drainage control is defined as measures which, when implemented, will minimize, to the extent practicable, disturbance to the prevailing hydrologic balance and to the quality and quantity of water in surface and groundwater systems due to surface disturbances associated with site characterization activities.

Drainage control specifications shall be followed and implemented such that overland flow and flow in ephemeral streams from undisturbed areas will be diverted away from disturbed areas by means of temporary or permanent diversions as needed to minimize erosion and prevent increased sedimentation and debris deposition downstream. A diversion is defined as a channel, ditch, culvert, embankment, berm, or other manmade structure constructed to divert water from one area to another. The use of diversions will comprise the majority of drainage control measures to be implemented during site characterization. The following good engineering practices shall be considered in the construction of diversions:

- Grading disturbed sites and recontouring sites such that natural drainage patterns are re-established, undue ponding of runoff is avoided, and erosion is minimized.
- In the event that a diversion consists of rerouting or altering an existing stream channel (including the ephemeral drainages at the Yucca Mountain site), the capacity of the diversion should be at least equal to the capacity of the unmodified longitudinal profile of the stream, the channel, and the floodplain above and below the diversion.
- Channel linings, if necessary, shall be designed to safely pass anticipated velocities and rip-rap will be used where necessary to minimize channel erosion.
- Minimum side slopes of 2h:1v will be constructed for all ditches and channels.
- Culvert installation, where necessary, will incorporate the use of end sections or concrete headwall and tailwall.
- Rip-rap or energy dissipaters will be installed at discharge points where diversions intersect natural channels at velocities greater than that of the receiving stream and, as needed, at the toe of cut and fill slopes.

Drainage control measures needed to divert undisturbed runoff away from disturbed areas will be determined for each individual surface-based investigation prior to site preparation. Construction of drainage controls are considered part of site preparation, and will be

maintained as necessary throughout site characterization until such time that final reclamation activities begin at a site. There may be some instances where it will be necessary to leave a particular control in place until reclamation has progressed sufficiently to render a site to a more stable condition. Those controls would then be reclaimed according to these reclamation guidelines.

2.6 SITE DECOMMISSIONING

Site decommissioning is herein defined as those steps following completion of a site characterization activity that will render a site to a safe, nonoperable condition. Decommissioning is defined as steps taken to place a facility in a permanently nonoperable, safe condition (DOE, 1989a). Once field sites, facilities, and access roads are no longer needed for YMP purposes, abandonment and decommissioning activities will begin.

The first step will be to determine if decontamination is necessary. Decontamination is herein defined as the selective removal of radioactive contaminants from an area. Decontamination is not expected to be necessary, since the use of radioactive materials are not planned to be used during site characterization. Following the determination of radioactive contaminants, an attempt will be made to identify an alternative use for a particular site, road, or facility. This will involve consultations with the BLM for sites and facilities on BLM administered lands (this is a condition of the right-of-way agreement between the DOE and BLM). For example, the main access road and some secondary access roads may be left in place to provide access to the Yucca Mountain area in the future, or boreholes that penetrate the water table may be left in order to develop a water supply source. Each particular site will then be abandoned according to the following measures.

All surface structures, hoisting equipment, generators, building materials, electrical and water distribution systems, and monitoring equipment, will be dismantled and removed from the site and salvaged; concrete pads and foundations will be reduced to rubble; pavement ripped up; and resultant debris and wastes disposed of at an approved landfill. Hazardous materials generated during site characterization shall be disposed of in accordance with applicable regulations. Buried water, electrical, and sewage lines will be disconnected below the surface and left in the ground.

If topsoil was not salvaged at a particular site, soil samples will be collected from soil material at the site and analyzed to determine suitability as a topsoil substitute, as described in the Draft *EFAP for Soils*. If determined to be suitable, these materials will be used as surface soils for reclamation purposes. If these surface soils are not suitable, soils may be borrowed from other disturbed areas that may have a greater volume of suitable soil than required for successful revegetation.

Excavated areas such as trenches, borrow pits, mud pits, shafts, and boreholes will be backfilled and sealed as appropriate. The following discusses in detail the guideline that shall be considered for field operations dealing with plugging and sealing underground openings.

2.6.1 Abandonment and Sealing of Underground Openings

Abandonment and sealing refer to all activities associated with the permanent closure of underground openings, including shafts, ramps, exploratory boreholes, and the underground facility. Sealing includes emplacing backfill and sealing elements, such as plugs, caps, and collars.

If the Yucca Mountain site is selected and operated as an underground repository for high-level radioactive waste, the seals for shafts and boreholes shall be designed so that following permanent closure they will not become pathways that compromise the ability of the geologic repository's system to meet the performance objectives for the period following permanent closure. Materials and placement methods for seals shall be selected to reduce, to the extent practicable, (1) the potential for creating a preferential pathway for groundwater, or (2) radioactive waste migration through existing pathways. Abandonment and sealing concepts and analysis are discussed in the SCP, Section 8.3.

In the event that the Yucca Mountain site is determined to be unsuitable for development as a repository, the following general guidelines for abandonment and sealing of underground openings shall be adhered to:

- All underground openings will be abandoned and sealed in accordance with applicable state and federal regulations, including Section 534 of the Nevada Administrative Code.

- Prior to abandonment of boreholes or wells containing potentially usable water and located within the BLM right-of-way reservation or on the Nellis Air Force Range, the DOE shall consult with the BLM to determine if such holes or wells will be sealed or turned over to the BLM to facilitate their development as water sources.

- For those boreholes where an alternative use is identified which would prohibit sealing, the hole will be left in a manner that would prevent contamination of groundwater; minimize disturbance to the prevailing hydrologic balance; and ensure the safety of people, livestock, wildlife, and machinery, including visibly marking the borehole and installing a lockable cap on the surface casing.

- At a minimum, sealing of boreholes would include removing all downhole instrumentation and tubing, placing a bentonite or grout seal between aquifers of significantly different water quality in order to minimize interconnection between the aquifers (this is not anticipated to be needed since the depth of those proposed boreholes that would penetrate the water table would be limited to the tuff aquifer), placing a concrete plug at the surface, cutting the casing off at the recontoured surface elevation, and capping the hole.

- The DOE will consult with federal and state agencies in an attempt to identify an alternative use for the ESF. If an alternative use is identified, the ESF would be left in place and periodic maintenance would preserve the structural integrity of the facility and physical security should be retained at the surface. If a future long-term alternative use for the ESF is identified, the strategy to preserve the facility should include temporarily capping the underground openings.

- If no alternative use for the ESF is identified, abandonment of the ramps and/or shafts may include removing equipment and structures; leaving in place concrete liners; use of the material that was removed during excavation may be used as backfill and underground workings; and permanent sealing of the openings in a manner that would prevent access to the underground workings by people, livestock, and wildlife, and to minimize disturbance to the hydrologic balance.

2.6.2 Disposal of Underground Development Waste

This special reclamation guideline for disposal of underground development waste shall be adhered to address surface disposal of mined rock placed in the muck pile during ramp and/or shaft sinking and development of underground drifts and test rooms. Underground development waste is defined as mined rock that is removed from underground workings during site characterization, and is not required as backfill for sealing underground workings, or as backfill for regrading support facilities. This muck will need to be temporarily stockpiled and possibly disposed of at the surface.

All underground waste excavated during ESF construction shall be stockpiled on the muck storage pad. The muck storage pad is considered part of the overall ESF area. Runoff will be diverted away from the muck storage embankment and topsoil stockpile area. The pad design will include a 40-mil thick PVC liner with a 12-inch thick sand backfill. A perforated pipe collection system will collect leachate water from the muck and discharge into a small, lined collection basin at the lower end of the pad. For the purposes of these reclamation guidelines, the leachate collection system and mine waste water settling basin are considered sumps. The reclamation of sumps is discussed later in this document.

The following specifications shall be included in the permanent disposal of any underground development waste on site:

- The material in the embankment shall be compacted as necessary to ensure mass stability, prevent mass movement, and ensure an acceptable long-term static safety factor.

- The final design configuration will not include depressions or impoundments on the embankment.

- Final slope angles will be no steeper than 2h:1v.

- If the material is to remain on the muck storage pile described above, the runoff resulting from a 100-year flood event will be permanently diverted around the embankment.

- Once the final design configuration has been reached, available stockpiled topsoil will be respread evenly across the embankment, and the embankment will be revegetated, if appropriate (the ability to revegetate underground development waste will be investigated as part of investigations described in the RFP.

2.7 RECONTOURING

Recontouring is the act of grading a disturbed site, if necessary, so that it is left as a stable land form that blends with the surrounding topography. Recontouring does not include distribution of stockpiled topsoil or seed bed preparation. These activities are discussed in Section 2.8.

The recontouring guideline consists of the following standard treatments. Following site abandonment, disturbed areas will be graded such that the natural drainage patterns (predisturbance drainage) are restored, the site is stabilized, and it blends in with the natural topography of the area. Recontoured slopes should be no steeper than 2h:1v, because vegetation is rarely satisfactory on slopes steeper than this (USDA, 1979a). Slopes will be this steep or steeper only where natural terrain or some other limitation prohibits further reduction. Recontoured surfaces will be roughened, as necessary - through ripping or chiseling, to permit better contact and stability between the surface and soil materials that are applied as topsoil. Sites that will not require any regrading or topsoil application will be disked and/or ripped as necessary to relieve compaction.

2.8 REVEGETATION

Revegetation is defined as the process of re-establishing vegetation on cleared areas. Revegetation is a complex process that is dependent to a large extent on natural conditions that cannot be controlled. The most critical of these conditions for the Yucca Mountain area is rainfall. The total amount of precipitation and its distribution are key elements to successful revegetation in desert environments (Wallace and Romney, 1980). Revegetation will attempt to establish vegetation native to the area as first priority. Techniques can be used that will optimize the use of available moisture (Jensen and Hodder, 1979; Anderson et. al., 1985).

Revegetation shall be accomplished through implementation of various techniques or combination of techniques. The techniques selected for revegetation depend on many factors, including the severity and extent of the disturbance, climatic and edaphic conditions of the site, topography, land use of the particular site, and aesthetic considerations. The most feasible and effective techniques for the Yucca Mountain area are being evaluated as part of investigations described in the RFP. A thorough literature review, contacts with personnel involved with reclamation in comparable areas, and field trials, also to be conducted as part of the RFP, will be used to further develop an effective revegetation program for the YMP. Although specific methods and materials for revegetation have not yet been determined for the YMP, the following standard techniques are applicable for consideration.

Sites will be brought back to a similar stable topography that existed prior to disturbance, as discussed in Section 2.7. Prior to spreading stockpiled topsoil (if available), the subsurface soil will be ripped where compaction is evident. Where topsoil has been stockpiled or is available from other areas, it will be distributed over the disturbed site. The method of spreading topsoil depends on the size of the disturbed area, the location of the topsoil stockpile in relation to the disturbed site, the amount of topsoil to be respread, and the slope of the recontoured site. For relatively small sites where the stockpile is adjacent to the site, such as drill pads, topsoil can best be spread by a bulldozer. For larger areas, such as the ESF area, where a large centralized stockpile will be utilized, scrapers or a combination of dump trucks and bulldozers will be needed for distributing topsoil. The topsoil that has been

stockpiled, or otherwise made available for spreading over a disturbed site, will be spread to a relatively uniform depth over the disturbed site.

Following topsoil distribution, a suitable seed bed will be prepared (USDA, 1979a; Ostler and Allred, 1987). Seed bed preparation may include disking and/or harrowing the site, depending on the degree of compaction of the soil; or the site may need to be firmed. This can be done using a cultipacker, roller, or by cat-racking (walking a tracked vehicle) up and down steep slopes that need to be firmed. The final surface of a site should be left in a roughened condition, such that small surface depressions are created in order to increase infiltration and decrease erosion (NPI Reclamation Services, 1985).

The need for using soil amendments to enhance revegetation efforts, such as application of fertilizers or incorporation of chemical or organic materials to ameliorate soil conditions, will be determined. The need for amendments would be based on a comparison of preactivity and prereclamation soil characteristics. For example, if nitrogen levels in soils exhibit a decrease from the time of predisturbance to prereclamation, nitrogen fertilizer may be added. This soil sampling and analyses are described in the Draft *EFAP for Soils*. If it is determined that amendments are necessary, the timing and method of application will be dependent on the type of amendment to be used.

Disturbed sites shall be revegetated following recontouring, topsoil distribution, and seed bed preparation (as necessary). The methods to be used to establish revegetated plant communities at these sites may include seeding and/or transplanting (USDA, 1979a).

2.8.1 Seeding

This is the least involved technique for establishing a revegetated plant community on disturbed sites. However, due to the unpredictability of precipitation in the Mojave Desert, the success rate of seeding is expected to be highly variable (Ostler and Allred, 1987). The components that will be evaluated as part of RFP investigations to further define the seeding program for the YMP include methods of seeding, timing, seeding rates, seed quality, and species selection. The feasibility of collecting seed from native species also will be examined as part of reclamation trials discussed in the RFP. In cases where seeding is followed by inadequate precipitation, reseeding may be necessary.

2.8.2 Transplanting

Planting of live plants is an alternative to plant establishment from seed, and is the practice that is currently being used in experimental trials at the NTS and other areas in the Mojave Desert with good success (Wallace, Hunter and Romney, 1980; Clary 1983; Ostler and Allred, 1987). Transplanting involves higher initial input in labor and plant materials compared with seeding. However, since transplanting involves plant materials that are more advanced in their development than seed, transplanting allows for more rapid and successful vegetation establishment in situations where seed germination and seeding establishment are difficult and success is highly variable (McKell, 1978). The feasibility of using transplants to establish plant communities at disturbed sites ~~also~~ will be evaluated by RFP investigations.

Following seeding and/or transplanting, disturbed sites will be mulched, unless it is demonstrated that mulching is not required. The need and applicability of using mulch following revegetation has not yet been determined, nor has the type of mulch. The

effectiveness and impacts of using mulch in the revegetation program will be evaluated during early revegetation trials and efforts.

Newly revegetated sites may need to be protected from grazing or browsing by large ungulates (including wildlife) and small mammals until plants are fully established (Hunter, Wallace, and Romney, 1980). This may require revegetated areas to be fenced. The need and techniques to protect newly planted areas will be evaluated as part of the RFP.

2.9 IRRIGATION

Irrigation is defined as the application of supplemental water to promote vegetation establishment and growth. Irrigation systems can be very complex or rather simple, depending on the effort and cost involved in establishing a system. Irrigation has been used in other desert locations to assist in revegetation efforts, but problems have arisen because plants tend to become dependent on irrigation and are not able to survive without it.

Irrigation is currently being used on the NTS only as a one-time application at the time of transplanting. Currently, this is the only application of irrigation that is being considered for the YMP.

2.10 POST-RECLAMATION MONITORING

Reclamation success at each disturbed area will be monitored following completion of reclamation activities. This monitoring is necessary to determine if the objectives of the reclamation program, which are defined in the RPP and were summarized in Section 1.1 of this plan, have been met by the implementation of the guidelines described herein.

2.10.1 Criteria for Reclamation Success

In the arid southwest, reclamation success is normally evaluated in terms of vegetative cover and productivity. Percent ground cover is an important indicator of vegetative erosion control, and productivity reflects the reclaimed land's ability to support predisturbance land use. Plant species diversity as well as usage by wildlife are valuable parameters in evaluating the potential carrying capacity of reclaimed lands.

The criteria for determining reclamation success will be based on quantitative estimates of the species diversity, percent of vegetative cover, and productivity of reclaimed areas. Vegetation study plots will be established to characterize vegetation associations in the YMP area. This investigation is described in the RFP. Vegetation study plots that are established in representative vegetation associations can serve as reference areas for measuring the success of reclamation efforts on reclaimed areas. Reference areas are commonly used by mining companies to validate the success of their reclamation efforts. Preactivity surveys will allow the reclamation specialist to determine the type of vegetation association that occupied the area prior to disturbance.

Criteria for assessment of reclamation success have not yet been determined. The information gathered during the monitoring phase of the reclamation trials, described in the RFP, will be used to assist in the development of reasonable criteria for assessment of reclamation success. The BLM will be consulted regarding proposed success criteria, as it is

the principal land management agency to which the DOE has a commitment to successfully reclaim disturbed lands, prior to finalization of those criteria.

2.10.2 Revegetation Monitoring

Reclaimed sites will be visited periodically to monitor vegetative growth and phenological condition. At each site both qualitative and quantitative measures of revegetation success will be collected. Qualitative evaluations of revegetation success will be based upon field observations of vegetative cover, species abundance, extent of bare ground and litter, and soil erosion. These qualitative evaluations will be made twice each year, once in the spring during the peak production season and once in the fall to assess the effect of summer conditions, during the first two years following reclamation. The reclamation specialist may recommend that sites be reseeded, receive transplants, be recontoured, have soil amendments added, etc. based on these evaluations.

Quantitative site monitoring will begin during the third spring following reclamation of the disturbed site, provided that reseeding has not been necessary. The same sampling methodology and parameters that are implemented as part of vegetation characterization studies and reclamation trial studies described in the RFP will be used for monitoring revegetated sites. These measures include percent cover by species, density by species, species diversity, phenological state, and productivity. Methods include using randomly located quadrats, line transects, and direct harvesting. Monitoring will continue annually or as needed until reclamation of the site is deemed to be successful.

Photography shall be used to further document the status of revegetation at all sites. Photography will be taken prior to disturbance, after site abandonment, following recontouring and revegetation, and during each annual monitoring visit. Follow-up photographs will be taken from the same location as the initial photograph.

2.10.3 Animal Use Monitoring

Surveys of reclaimed sites shall be conducted to monitor the extent of grazing on newly established plants and to document land use by wildlife species. Significant use of reclaimed sites by biota may affect the outcome of revegetation efforts. The use of reclaimed sites by wildlife to an equal or greater degree than similar undisturbed habitats would indicate that the objective of habitat restoration to a productive use is being achieved by the reclamation program. These areas will be monitored annually or as needed.

Belt transects, randomly distributed within each reclaimed site, should be walked at the same time as revegetation monitoring. Transect size will be determined on a site specific basis, based on size of the site. Observed parameters will include animal burrow density, extent of grazing, reptile density, ant mound density, and densities of wildlife scats. The number of birds and other wildlife observed on the site throughout the monitoring visit will also be recorded.

3.0 RECLAMATION IMPLEMENTATION ACTIVITIES ASSOCIATED WITH SPECIFIC OPERATIONS

The guidelines discussed in Chapter 2.0 are presented in this chapter by explaining how each guideline pertains to various types of activities. Site characterization activities have been grouped in this section according to the type of field operation associated with them. Field operations consist of the following:

- ESF area.
- Drilling, including drill pad and mud pit construction.
- Excavations, including trenches, pits, and borrow areas.
- Geologic pavements.
- Access road construction.
- Activities that involve off-road and casual use.
- Abandonment and sealing of underground openings.

This section describes the site characterization activities and site preparation requirements for each of these types of field operations. The sequence of reclamation guidelines that will be implemented at each disturbed area follows this activity description discussion. The matrix presented in Table 3-1 summarizes which reclamation guideline activities that shall be considered at each type of field operation.

Before any new or expanded field activity is initiated, the Affected Organization must receive clearance from the YMSCO, following YAP-5.6Q, *Field Work Activation*, and YAP-30.2, *Land Access and Environmental Compliance*. In order to receive this clearance, the Affected Organization must determine the actual surface location of the activity and submit a criteria letter requesting the YMSCO engineering and construction contractors to determine site preparation and access needs. Preactivity surveys will be implemented prior to site preparation for each field activity. The results of the preactivity survey will be submitted to the Affected Organization for incorporation into site preparation specifications.

3.1 ESF AREA

The surface facilities of the ESF area will consist of the ventilation system for the ramps and/or shafts and underground facilities, temporary office and laboratory space and change rooms provided by prefabricated metal buildings, parking areas, materials storage facilities, a complete maintenance and repair shop, warehouse, hoist building, communication shelter, surface data building, staging areas, and site security.

ESF pads will be constructed to minimize the effects of pad construction on site integrity. Topsoil will be removed and stockpiled on the 0.6 ha (1.5 acre) topsoil stockpile pad. Excavation of pads will be approximately 22 cm (9 in) below final grade. Type II material (gravel) will be placed in two lifts and compacted to 95 percent maximum at optimum moisture. Pads used for heavy traffic such as vehicle turnarounds or access to main pads will be double oil and chip paved. Lightly traveled areas and parking areas will be lightly oiled and sand blotted as required.

Fill material for pad and road construction will be excavated from a borrow area.

Table 3-1 Reclamation Activities for Site Characterization Field Activities

	ESF	DPC	TDR	EXC	PVT	ARC	ANC	ORV	PDS
Preactivity Surveys									
Biotic resources	X	X	X	X	X	X	X	X	
Edaphic resources	X	X		X	X	X			
Archaeological resources	X	X	X	X	X	X	X	X	
Site location acceptability	X	X	X	X	X	X	X	X	
Site Clearing Specifications									
Vegetation removal	X	X		X	X	X			
Soil removal	X	X		X		X			
Topsoil Storage and Management									
Direct replacement		P		P	P	P			
Stockpiling specifications	X	X		X		X	P		
Erosion protection	X	X		X		X	P		
Erosion Control Measures									
Biological treatments	X	X		X					X
Physical treatments	X	X		X	X	X	X		X
Chemical treatments	X	P		P		X	P		X
Drainage Controls									
Divert undisturbed runoff	X	X		X	P	X			X
Control disturbed area runoff	X	X		X	X	X	P		X
Site Abandonment									
Decommissioning actions	X	X		X		X			X
Sealing boreholes	X	X	X						X
Sealing underground openings	X								
Prereclamation soil analysis	X	X		X	P	X			X
Recontouring									
Stabilize site	X	X		X	P	X	X		X
Ameliorate compaction	X	X	P	X		X	P		X
Re-establish drainage patterns	X	X		X		X	X		X
Revegetation Activities									
Topsoil distribution	X	X		X	P	X	P		X
Seed bed preparation	X	X	P	X	P	X	P	P	X
Revegetate site	X	X	P	X	P	X	X	P	X
Mulch site	X	X		X	P	X	X		X

	ESF	DPC	TDR	EXC	PVT	ARC	ANC	ORV	PDS
Supplemental Irrigation	P	P	P	P	P	P	P	P	P
Post Reclamation Monitoring	X	X	X	X	X	X	X	X	X

ESF = Exploratory Studies Facility
DPC = Deep drilling that will require drill pad construction
TDR = Shallow drilling done by truck-mounted drill rig that does not require site preparation
EXC = excavations
PVT = pavements
ARC = access road construction
ANC = access that does not require construction (e.g., trails)
ORV = off-road use
PDS = previously disturbed sites
X = reclamation activity is applicable to the field activity
P = guideline is potentially applicable to field activity depending on factors including location, amount of disturbance not related to site preparation, etc.

Surface utilities will include a power distribution system fed from an existing substation. Standby power will be provided by diesel engine generators. A water distribution system will be constructed and operated to supply potable, fire protection, and process water. Water is expected to be supplied by existing well J-13 located on the NTS. A sanitary waste sewage system will provide for the collection, treatment, and disposal of sanitary waste generated at the site. The mine waste water collection system will handle nonsanitary industrial mine waste water. Mine water will be delivered to the surface and released into a lined pond for settling. The settling pond is sized for a three-day detention time to settle suspended solids for the maximum design flow. If sufficient quantities of water are pumped from underground to cause the settling pond to discharge (expected water amounts are far less than design capacity), water will be discharged into a wash below the ESF area.

Each site that will be disturbed within the ESF area will be cleared according to those methods described under the site clearing guideline. Topsoil material that is removed will be stockpiled in a central topsoil stockpile area that has been designated as the Topsoil Stockpile Pad. This stockpile will be utilized for topsoil stockpile studies described in the RFP, which will include evaluation of revegetation strategies involving seeding with different species mixtures, fertilization treatments, and possibly evaluating effectiveness of mulch.

Erosion from the ESF area will be controlled by limiting the amount of surface disturbance, routing runoff around disturbed sites using diversions and berms, and by surfacing heavy traffic areas. Heavy traffic areas will be paved. Water spray will be used during site preparation to control dust and aid in compaction of fill slopes.

Drainage controls for the ESF will divert runoff resulting from a 100-year, 24-hour precipitation event (100-year flood) from encroaching on the ESF area. Runoff from the ESF area will be routed to collection ditches that are sized to control runoff from a 25-year flood event and routed to natural or reconstructed drainage channels. Rip-rap will be placed as necessary to control stream erosion and scouring.

Fill slopes, and side slopes of diversions within the ESF area, will be limited to 2 to 1 or less. Fill slopes and pads will be compacted to 95 percent maximum density. Depending on results of early RFP investigations, slopes may be revegetated temporarily during ESF operations to assist in controlling erosion.

Decommissioning of the ESF area is discussed in the SCP. This represents a summary of that discussion. Decommissioning of areas not needed for future use of the facility will occur as soon as practicable, and in accordance with all applicable federal, state, and local regulations. Portable and prefabricated buildings will be emptied of their contents, dismantled, and removed from the site. Unneeded equipment, electrical generators, electric and water distribution systems, ventilation equipment, meteorological towers, and communications equipment will also be removed from the site and salvaged. Foundations will be reduced to manageable pieces and trucked to appropriate disposal sites. Surfacing material for access roads, parking areas, and other paved or graveled areas will be removed from the site and disposed of in an approved landfill. Buried water, electrical, and sewage lines will be disconnected below the surface and left in the ground.

Equipment and materials will be removed from underground workings. The ramps and/or shaft liners will be left in place. Horizontal and vertical boreholes drilled underground will be sealed. Subsurface drifts, rooms and exploratory shafts may be backfilled with the material that was removed during excavation and placed in the muck storage area. This would minimize the amount of material to be stabilized or disposed of on the surface. The reclamation guideline for disposal of underground development waste, if applicable, is presented later in this section.

Once shafts are sealed, excavated areas are backfilled, and buildings and other surface structures or materials are removed, reclamation of the site would proceed according to the guidelines presented in Chapter 2.0 of this document.

3.2 DRILLING

The YMP has developed a drilling program that includes some conditionally planned drilling methods (to be evaluated through a prototype drilling program) and planned boreholes that are dependent on the results of other investigations. Because of this, some modifications to the drilling program can be expected as the YMP progresses. The exploratory drilling and testing program will include: (1) unsaturated zone drilling and testing, (2) water table monitoring and saturated zone testing, (3) natural and artificial infiltration and natural groundwater recharge investigations, (4) systematic drilling and coring to geostatistically investigate the rock properties of the proposed repository host rock, (5) geological coreholes, (6) in situ stress testing (to be conducted outside the controlled area boundary), and (7) coring to support paleoclimatology investigations.

In terms of surface impacts associated with the site preparation required for proposed drilling activities, the drilling of boreholes needs to be separated into two broad categories based on depth and associated drilling equipment. Shallow boreholes, typically less than 60 m (200 ft) in depth will be drilled using an all-terrain, rubber-wheeled truck-mounted drill rig. Drilling of these holes will not require any surface preparation. This type of drilling will be done for the majority of boreholes associated with the YMP. Included are the natural infiltration monitoring holes, the artificial infiltration monitoring holes, the Fortymile Wash recharge monitoring holes, and seismic shotholes (the total number depending on final spacing requirements of seismic source, these are tentative at the present time). Deeper boreholes, and holes that involve wireline coring techniques will require construction of a drill pad.

Boreholes that are associated with infiltration and recharge studies will be drilled to provide access for monitoring the moisture content of the surficial materials of the unsaturated zone with a neutron moisture meter. Disturbance associated with this drilling will be limited to off-road access to each borehole location by the truck-mounted drill rig.

Site preparation required for drill pad construction involves providing an area that is level and cleared of vegetation. The extent of surface disturbance will be dependent on the site location and type of drilling, or drill rig used. Disturbance will vary from simply clearing vegetation and grading level the surface area needed for drilling and support equipment, to cut and fill construction necessary to provide a leveled surface area on hill slopes.

The majority of drilling is expected be done dry, meaning that only air will be used as the drilling circulation medium. Dry drilling will not require the construction of a mud and cuttings pit, as all cuttings and core will be collected for possible sample analysis. For those holes that are located outside the controlled area boundary, where introduction of water is not a concern to performance assessment or test interference, drilling fluids (drilling mud and/or foam) will be used for circulation. Where drilling fluids are used, a mud pit will be excavated as part of the drill pad, and lined with bentonite, or similar low permeability earthen-type material.

Different reclamation guidelines will apply to the two different types of drilling summarized in the previous paragraphs. For shallow boreholes, the only reclamation guideline that is applicable is the preactivity survey (Section 2.1). The preactivity survey will be limited to biological and archaeological resources. No soil sampling and analysis is required because vegetation and soils will not be removed. The objective of the majority of these holes (the exception would be seismic shotholes) is to investigate natural and artificially induced infiltration of the surficial materials under undisturbed conditions. Therefore, site clearance and topsoil management will not be applicable. Because most of the disturbance will be limited to simply drilling the holes, subsequent erosion, drainage control, recontouring, and revegetation should not be required. The use of water to control fugitive dust may not be allowed because of its potential impacts to investigation objectives. Abandonment and sealing of boreholes shall follow the special guideline for that activity presented in Chapter 2.0.

Deep boreholes that require pad construction will require the implementation of all guidelines presented in Chapter 2.0. After the final location of boreholes has been determined and the field location staked and surveyed, the construction and engineering contractors will determine the amount of site preparation required at each site. This will be dependent to a large degree on the siting of the borehole. Attempts will be made to locate drill sites on relatively flat, stable, nonsensitive areas, and, if possible, not in ephemeral drainage channels.

The preactivity survey will then be conducted. Soil and vegetation removal information obtained as a result of preactivity soils investigations will be provided as input into final site preparation specifications for the construction contractor.

Drill pads will be cleared of topsoil (if present) and vegetation. Woody vegetation will be removed separately from soil so as not to impede soil removal. Woody vegetation that is not to be salvaged for transplanting, will be placed on the downslope edge of the drill pad to act as a vegetative sediment filter for any runoff from the pad.

The drill pads will be graded level (for drill pads on slopes, this will require some cut and fill). If needed, drainage diversions (e.g., ditches or berms) will be constructed to divert any upslope runoff around the pad. The pad should not be bermed in an attempt to prohibit runoff from the pad, and channeling of runoff from pads that would create accelerated erosion on any fill slopes will be avoided. This may require periodic grading maintenance on pads to prevent rilling and gullying. Ponding of water on the pad should be avoided because of potential sensitivities to the characterization and performance assessment of the unsaturated zone above the potential repository horizon. A limited amount of water to

control dust during drilling and testing will be required. This water may be "tagged" with a conservative tracer, such as lithium bromide. Tagging would enable tracking of the waters used for dust control. Depending on the results of early RFP investigations, it may be possible to seed the non-use surface area of drill pads with a quick germinating and growing stand of temporary vegetation, as discussed previously in Section 2.4.

The investigators conducting the preactivity surveys will recommend the location of the topsoil stockpile and any controls, such as ditches or berms around the base of the pile, based on the configuration of the site and the amount of salvageable material. The stockpile will be located where it will not be impacted by drilling and testing, and will be least subject to potential erosion. The topsoil stockpile should not exceed depths greater than six feet, nor have slopes steeper than 2 to 1. Depending on the length of time the drill pad will be needed, it will either be sprayed with a mulch or chemical binder (if less than six months) or seeded with a temporary seed mix that will be specified as part of investigations described in the RFP. Mulching, following or as part of seeding, is also recommended to reduce wind erosion.

After drilling, boreholes will be protected to prevent contamination of groundwater, accidental accumulation of debris and entry of wildlife. Once a borehole is no longer deemed necessary for program purposes, the site will be decommissioned and the borehole plugged according to the guideline described in Section 2.6. An alternative to plugging boreholes on BLM administered lands, following site abandonment, will be to leave the holes open, with surface casings capped, in order to develop them as sources of water. The DOE will consult with the BLM prior to plugging any boreholes on BLM lands, to determine if plugging and sealing should proceed. The site will then be recontoured according to the guideline described in Section 2.7, including ripping, as necessary, to relieve surface compaction. Any stockpiled topsoil material will then be respread to an approximate uniform depth over the recontoured site and the area will be revegetated. The need for soil amendments will be based on results of preactivity and prereclamation soil sampling and analysis, as described in the Draft EFAP for Soils. At the time of this final reclamation, the site will be examined to determine if any drainage controls will be required until such time as the site is deemed suitably stable.

The majority of deep drilling for site characterization is planned to be done dry. Therefore the construction of mud pits to control drilling circulation fluids will be limited to water table holes and coreholes drilled using conventional drilling methods outside the controlled area boundary. The drilling methods for each planned hole are listed in the *Yucca Mountain Project Surface-Based Investigations Plan*, YMP/88-25. For those holes requiring the construction of mud pits, the following special guideline applies (the leachate collection system for the muck storage pile is also considered a sump and is therefore included here, as is the mine waste water settling pond).

Sumps are defined as excavations that are intended to collect waste waters resulting from site characterization activities. Sumps include: (1) mud and cuttings pits that are excavated as part of drill pad construction, (2) the mine waste water system settling pond, and (3) the leachate collection system for the muck pile.

Sumps will be sized to prevent uncontrolled discharge of waste waters. Lining will be used where deemed necessary to prevent or limit infiltration of waste waters. The muck storage pile design includes a 40-mil thick PVC liner with a 12-inch thick sand backfill and a perforated pipe collection system to collect leachate water, and discharge it into a PVC lined collection basin where it can be tested and released or treated first if necessary. The mud and cuttings pits used for drilling fluid returns the discharge, and the mine waste water settling pond will be lined with bentonite clay or some other similar earthen material of low permeability.

Prior to backfilling mud pits, samples of solid residues will be collected for analyses of toxic and/or hazardous materials (none are anticipated, but sampling will be conducted as a precautionary measure). Liquids will be allowed to evaporate from mud pits, which will be backfilled with excavated material, then compacted with backfill as necessary to limit potential future settling.

If the muck, which consists of rock excavated during construction of the exploratory shafts and drifts, is used as backfill, it will first be removed for plugging and sealing of the shafts and drifts. The PVC liner also will be removed and disposed of in an appropriate manner, the site will then be regraded according to recontouring guidelines. If the material in the muck pile is not used to backfill the shafts and drifts, the liner will be left in place and the pile reclaimed according to guidelines for disposal of underground waste.

In order to implement reclamation procedures such as recontouring, the PVC liner will be removed from the leachate collection pond, the pond and mine waste water settling basin will be backfilled, and the areas will be regraded and revegetated, as appropriate, according to the general guidelines for recontouring and revegetation.

3.3 EXCAVATIONS

The majority of excavations associated with the YMP will result from excavations of trenches for site characterization studies. The SCP has identified the need to excavate up to 28 trenches for tectonic (quaternary faults) and paleohydrology studies. Depending on the results of reconnaissance investigations that will be conducted to determine possible trench locations needed to adequately investigate potential quaternary faults, this number of trenches will likely change.

Excavation of trenches will be done with either bulldozers or backhoes. The size and depth of trenches will vary depending on the feature being investigated. The amount of disturbance associated with trenches has been conservatively estimated at 6 ha (15 acres). Excavated material will be stockpiled adjacent to the trench and will be used as backfill when the trench site is reclaimed.

Following the completion of artificial infiltration ponding studies some locations, which exhibit higher permeability rates, indicating the possibility of a highly fractured rock mass, may be excavated to depths as great as 7 m (25 ft). This will be done to map flow patterns. Up to six such excavations are possible. These "ponding" studies consist of placing a small (approximately 15 cm or 6 in) berm of impervious material, such as a concrete stem wall, around a neutron access hole used initially to monitor natural infiltration. Water will be

impounded within the berm (covering an area of approximately 10 m^2 or 100 ft^2) until a continuous wetting front is established. The water will be "tagged" with some type of tracer that will allow the flow pattern to be mapped at those sites that are excavated. Up to 50 such ponding sites may be established. Again, other than placing the "berm" around the neutron access hole, no site preparation is required, and disturbance will be avoided because the intent of this investigation is to monitor the permeability of the surficial materials under undisturbed conditions. The amount of disturbance associated with the excavation of the pits to map the flow patterns is included in that estimated for trenches.

The only borrow area that is planned for the YMP area at this time is the one associated with the ESF area. As such, that borrow area was addressed as part of the overall ESF area. Small soil pits that are dug by hand, or backhoe, are not included here, as they will be small in size and will only be of short-term use. These will be backfilled.

Where possible, excavations will be located such that interference with natural drainage and runoff is minimized. This will include excavating trenches parallel to the gradient, thereby intercepting less overland flow and, if possible, allowing precipitation to drain from the lower end of the trench.

Preactivity surveys will be implemented at each excavation site. Any soil material that is suitable for salvage will be removed and stockpiled adjacent to the trench site, such that it will be segregated from the other excavated material and will not be impacted by excavation and testing operations. The topsoil stockpile will be protected from erosion, including constructing a berm or ditch around the base of the pile and seeding and/or mulching, as needed.

Temporary diversions (berms or ditches) will be constructed where required to prevent runoff from channeling into excavations and around excavated material temporarily stockpiled on the surface.

Following the completion of testing, trenches will be backfilled with excavated material and recontoured. Any stockpiled topsoil will be spread to an approximate uniform depth over the site, and the area will be revegetated. The need for soil amendments will be determined based on preactivity and prereclamation soil sampling and analysis.

3.4 PAVEMENTS

These are also referred to as bedrock and geologic pavements, and in this context refer to a bedrock surface that has little or no regolith covering. Pavements are used to study surface fracture networks, which involves the mapping and measurement of fracture patterns in surface bedrock. Planned pavement studies will be undertaken only where bedrock is relatively close to the surface. In some instances, clearing of thin layers of regolith may be needed to expose a sufficient amount of bedrock. Where this is necessary, water will be used to clear the area. Displaced material will be collected adjacent to the cleared area. The amount of disturbance associated with pavement preparation is not yet known and is dependent on further reconnaissance of the potential locations.

Where pavement preparation is required, the site inventory process will be conducted. Because this study involves the mapping of natural fracture patterns in bedrock, the use of mechanized equipment will be prohibited. Therefore, where necessary, bedrock will be cleared by spraying water under moderate pressure on the surface. Where this is done, a berm or settling basin will be constructed at the down slope edge of the pavement area in such a manner that runoff is collected and controlled to prevent undue erosion from occurring during site preparation. The berm or basin also will collect any topsoil material for use in reclaiming the site, if appropriate.

Since pavements will be located where bedrock is already fairly well exposed and any soil depths would be minimal, the feasibility of salvaging topsoil will be unlikely (preactivity soil investigations will be conducted at any rate). Therefore, the remaining reclamation guidelines described in Chapter 2.0 may not be applicable to pavements. If suitable soil material is present, and is collected by the settling basin, it will be respread to an approximate uniform depth, and the site revegetated. Settling basins and/or berms that are constructed to control erosion during site preparation will be graded to approximate original contour and revegetated.

3.5 ROADS

Roads are defined herein as routes used for repeated vehicle access to field sites, including the ESF area, for the purpose of conducting or supporting site characterization investigations. Not included in this definition is infrequent off-road vehicle use; it is described later.

Three types of roads will be constructed during site characterization. These consist of: (1) light-duty improved roads, (2) unimproved roads, and (3) one-lane dirt tracks or trails. The light-duty improved roads are limited to the main access road to the ESF area, and access and haul roads associated with the ESF. The main access road will be two lanes, 7 m (23 ft) wide, with at least 1 m (3 ft) wide berms (increasing to as much as 6 m (20 ft) in places), and surfaced with a double oil and chip layer. When drainage ditches, berms and borrow ditches are considered, the average width of disturbance associated with the main access road is estimated at 15 m (50 ft).

The unimproved roads will be constructed wide enough for two-lane vehicle traffic. These roads typically will be graded roads, with the need for placing road-base material or gravel dependent mainly on the terrain and the existing surface materials. Considering the construction of drainage ditches, berms, and cut and fill slopes, the average width of disturbance is estimated at 15 m (50 ft) for these roads.

One-lane dirt tracks or trails will be required to access infrequently visited or short-term field sites, such as trenches, streamflow monitoring stations, and bedrock pavement sites. These trails will be bladed or simply consist of vehicle tracks. The need to blade a track to provide access to a field site will be dependent on the terrain. An average disturbance width of 4.5 m (15 ft) is estimated for these roads.

Based on the approximate location of proposed field activities that will require access by new roads (the existing road network is fairly extensive, and will be used wherever possible), disturbance associated with access road construction is estimated to be approximately 50 ha (125 acres).

Road construction will incorporate the use of standard engineering practices and procedures referenced by the American Society for Testing and Materials, the American Association of State Highway and Transportation Officials, and the State of Nevada Department of Transportation.

The existing road network will be used for access to planned site characterization field operations to the extent possible. Where construction of new improved and unimproved access roads are needed for access to a particular site, the Architectural and Engineering contractor will lay out the proposed route. For one-lane dirt tracks or trails, the access route may be determined by the Architectural and Engineering contractor, the principal investigator or designee, or the YMSCO representative. Access routes will be dependent on the final siting of field operations. Once an access route has been determined and flagged in the field, preactivity surveys shall be conducted. If desert tortoises, tortoise habitat, other protected species, or archaeological sites are present in the proposed access route, attempts will be made to re-route the access road. If access cannot be provided which avoids protected biological and archaeological resources, appropriate mitigation measures will be taken, as outlined in the *Environmental Monitoring and Mitigation Plan for Site Characterization*, DOE/RW-0208, or the Biological Assessment of the Effects of Site Characterization Activities on the Endangered Desert Tortoise.

Prior to the construction of all improved and unimproved roads, available topsoil shall be removed and salvaged. The presence of topsoil, the amount to salvage, and the specific method of stockpiling will be determined during conduct of the pre-activity survey for the road right-of-way. The method of topsoil stockpiling will be determined by the reclamation specialist; possible alternatives include depositing it in a stockpile location or forming windrows of salvaged soil along the edge of the disturbed access route. Stockpiled topsoil will be protected from erosion according to the alternative methods discussed in Chapter 2.0.

It will not be necessary to conduct preactivity soil investigations along access routes for one-lane dirt tracks or trails because construction of these roads usually will not be necessary. If terrain dictates the need to have heavy equipment blade an access path to a particular site, any soil material should be bladed into windrows along the edge of the paths for subsequent use during reclamation of the path. If sufficient soil material exists, it should be protected from erosion in the same manner as is employed for improved and unimproved roads. Attempts will be made to locate these roads such that potential impacts, such as erosion, will be minimized. If deemed necessary, water bars will be installed on slopes to prevent runoff from channeling down roadways.

For improved and unimproved roads, adequate drainage controls shall be provided at the time of construction. These controls include, but are not necessarily limited to, the following:

- Providing sufficient surface grades and grade breaks such that water will drain and not pond or puddle on the surface, nor be channeled down roadways, including crowning from the center line or sloping toward the ditch line.

- Construction of ditches on both sides of through-cuts and on the inside shoulder of a cut-and-fill section.

- Installation of cross-culverts on grades such that natural drainage patterns are maintained and runoff is diverted from fill slopes.

- Installation or construction of drainage structures where roads cross drainages, such as surface dips, bridges, or culverts with trash racks and debris basins installed to prevent plugging of drainage structures.

Unpaved access roads will be sprayed with water or a mixture of water and chemical dust suppressant, as needed to control fugitive dust from roads that are in active use.

Conceptual drainage control specifications for ESF access and haul roads were included in Title I design. Adequate drainage controls have been provided to control runoff.

Once it is determined that a road, or portion thereof, is no longer needed, it will be reclaimed. The DOE will consult with the BLM regarding the disposition of any access roads that are on BLM-administered land prior to reclaiming roads. Pavement will be ripped up and disposed of according to specifications discussed for solid waste in the *Environmental Regulatory Compliance Plan*, YMP/92-2. Drainage structures will then be removed as necessary. Road surfaces will be recontoured, including ripping to relieve compaction (final ripping should be at a 90-degree angle to the slope) and any shoulders, berms and drainage ditches will be regraded to blend in with the natural undisturbed topography. Any stockpiled soils will be respread over the surface of the disturbed area. Natural drainage channels that may have been crossed will be reclaimed. Roadways will be revegetated, as applicable, according to the revegetation guideline.

3.6 OFF-ROAD AND CASUAL USE FIELD OPERATIONS

Many of the data needs for site characterization require measurements at or above ground surface without the need for site preparation. These include meteorological monitoring, radiometric monitoring, geodesy, seismic monitoring, evapotranspiration studies, geologic and surficial deposits mapping, and geophysical surveys. These investigations will involve the following kinds of field activities:

- Passive monitoring equipment on the surface or on towers.

- Construction of survey monuments, small edifices, etc.

- Geophysical use of noninvasive seismic or electrical sources.

- Deployment of ground motion detectors or other geophysical instruments.
- Infrequent off-road vehicular travel.

For these types of activities, no new roads will be constructed and off-road travel that is required will be kept to a minimum. These activities will be subject to the activity approval process described in Chapter 4.0, and may require a site inventory to be conducted (without soil sampling and analysis, because no site preparation will be required). The Assistant Manager for Environment, Safety, and Health (AMESH) of the YMSCO will determine if activities will require preactivity surveys for biological and archaeological resources.

The amount of disturbance associated with off-road vehicle use, which does not require site preparation and will result in only minor short-term disturbances, has been conservatively estimated at 70 acres. The majority of this disturbance will be associated with deployment of ground motion detectors and use of handheld portable shallow seismic sources for geophysical sources.

Casual use operations consist of those activities that will not result in surface disturbances. These include reconnaissance investigations, geologic mapping, erosion observations, and surveying activities.

If off-road vehicle use results in compaction of soils, disking may be required to relieve compaction. If so, disking will be conducted along the contour to promote infiltration and decrease potential for channeling runoff down tire tracks. Revegetation should not be necessary since the minimal amount of disturbance that is involved should not result in vegetation removal.

3.7 PREVIOUS DISTURBANCES

There are disturbances that occurred at Yucca Mountain prior to the initiation of the site characterization phase of the repository program. These disturbances consist of drill pads, access roads, trenches, pavements, installation of meteorological monitoring stations, and site clearing for equipment storage areas. The SCP has estimated that approximately 930 acres of surface disturbance has occurred within the general vicinity of the YMP area. It should be noted that not all of these impacts are associated with the Yucca Mountain waste repository program. Many of the existing roads and power lines in the Fortymile Wash area are associated with NTS activities. Several roads that have been constructed in the Bare Mountain, Crater Flat, and Amargosa Desert areas were not constructed by the DOE, nor were they constructed to support the YMP. Areas that were disturbed by previous repository-related activities will be reclaimed in a fashion similar to reclamation of areas disturbed by site characterization.

Additional and/or ongoing site characterization activities are planned for many of these sites. Those sites that are no longer needed for site characterization will be reclaimed. Most of these sites will be used for disturbed habitat and reclamation trial studies described in the RFP. The YMSCO, with concurrence from appropriate Affected Organizations will determine which of these sites are no longer needed for site characterization.

4.0 SITE-SPECIFIC RECLAMATION STIPULATIONS

Not all reclamation guidelines and reclamation activities discussed in Chapter 2.0 will be implemented at each site characterization activity location. Those reclamation guidelines that are applicable to specific categories of field operations, will be implemented to varying degrees depending on the characteristics of the activity location, including such factors as topography, type of soil present, and drainage characteristics. The reclamation specialist will determine reclamation stipulations that are applicable for each site. This determination is part of the site activity review and approval process, which is described in the following paragraphs.

Once it has been determined that a particular site characterization activity is required, and a description of the activity has been developed, approval to implement the activity must be obtained from the YMSCO. This approval process requires varying levels of review, and is summarized below.

All Affected Organizations must receive clearance from the YMSCO before initiation of any new or expanded field activity, as specified in YAP-30.2. A request for such clearance is submitted by the Affected Organization to the AMESH in the form of a request to initiate site activity letter which contains the following information on the proposed activity: exact location (plotted on a map of the area and exact locations must be marked in the field), summary of actions proposed, estimated time of year for implementation, and technical contact or principal investigator.

The request is then referred to the designated AMESH staff member who in turn requests the review of the activity for: (1) environmental technical programmatic sufficiency; (2) potential environmental impacts (including mitigation and reclamation requirements, if any); (3) environmental regulatory compliance requirements; (4) adequacy of current monitoring activities; and (5) compliance with applicable regulations, requirements, and guidance. This clearance process addresses the following technical areas:

1. Land Access
2. Terrestrial ecosystem impacts
3. Cultural resources impacts
4. Permitting
5. Reclamation guidelines
6. Air quality impacts
7. Radiological environmental impacts
8. Water resources impacts
9. Regulated hazardous substances and material authorization

Based on the findings of the environmental technical review, the request to initiate site activity letter is either approved or denied. Approval may be conditional, and require that a number of requirements be met prior to site disturbance. These include the implementation of on-site pre-activity surveys as described in EFAPs for terrestrial ecosystems, cultural resources, and soils. The activities described in the site inventory guideline will be conducted in conjunction with those pre-activity surveys. If these surveys are required, they must be completed before final site activity letter approval is processed.

As a result of the pre-activity survey process, conducted according to the site inventory guideline, site-specific reclamation stipulations will be developed for each disturbance area. The stipulations will address those reclamation activities that need to be implemented prior to or at the time of site preparation. They will be developed for each location by the reclamation specialist. The stipulations will be submitted to the YMSCO, and then forwarded to all of the principals involved in the implementation of the activity. These activities are defined in the RPP as interim reclamation activities that are implemented before and during disturbance.

These interim reclamation stipulations will address those activities that need to be considered by the engineering and design contractor during any site design process that is needed, and implemented by the construction contractor. The stipulations will address site clearing, topsoil storage and management, and site stabilization measures that need to be implemented during site characterization, including use and installation of erosion and drainage controls.

After the YMSCO has determined that field sites are no longer required for site characterization, with concurrence from appropriate participants, site abandonment and decommissioning will proceed, as necessary. The construction contractor will proceed with site abandonment and decommissioning activities as described in Section 2.6 for appropriate field operations as discussed in Chapter 3.0. Any consultations that are necessary, as discussed within this RIP, will be initiated by the YMSCO. The YMSCO will request the reclamation specialist develop a final reclamation activity checklist, based on the results of a post-activity reclamation survey. Final reclamation activities are those described in the RPP as occurring after site characterization has been completed.

Final reclamation activities will include site stabilization, including recontouring and installation of any final erosion and drainage controls that may be necessary, and revegetation. The reclamation specialist will request support from the engineering and construction contractors, as necessary, through the YMSCO.

Following final reclamation the reclamation, specialist shall conduct post-reclamation monitoring, as described in Chapter 2.0. This monitoring will be conducted to determine the success of completed reclamation activities. If it is determined during this monitoring that additional reclamation activities are needed, they will be proposed by the reclamation specialist and submitted to the YMSCO for consideration. This will ensure that the reclamation objective of returning lands disturbed by site characterization activities to a stable ecological state with a form and productivity similar to the predisturbance state, has been successfully achieved.

APPENDIX A

REFERENCES

APPENDIX A

REFERENCES

NOTE: Unless otherwise stated, refer to the latest revision or interim change of the referenced document.

Identifier	Title
Public Law 95-87	Surface Mining Control and Reclamation Act of 1977
30 CFR 817	Permanent Program Performance Standards-Underground Mining Activities
DOE/RW-0199	Site Characterization Plan
DOE/RW-0208	Environmental Monitoring and Mitigation Plan for Site Characterization, Revision 2
DOE 1989	Biological Assessment of the Effects of Site Characterization Activities on the Endangered Desert Tortoise
DOE 1989	Draft Reclamation Program Plan for Site-Characterization Activities
DOE 1989	Draft Yucca Mountain Project Reclamation Feasibility Plan
YMP/88-25	Yucca Mountain Project Surface-based Investigations Plan
YMP/90-11	Draft Environmental Field Activity Plan for Soils
YMP/91-41	Environmental Field Activity Plan for Terrestrial Ecosystems
YMP/91-42	Environmental Field Activity Plan for Air Quality
YMP/92-2	Environmental Regulatory Compliance Plan
YMP/92-15	Environmental Field Activity Plan for Archaeological Resources
YMP/93-04	Environmental Management Plan
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APPENDIX B

ACRONYMS AND ABBREVIATIONS

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AMESH	Assistant Manager for Environment, Safety, and Health
BLM	Bureau of Land Management
DOE	U.S. Department of Energy
EFAP	Environmental Field Activity Plan
ESF	Exploratory Studies Facility
NTS	Nevada Test Site
NWPA	Nuclear Waste Policy Act of 1982, as amended
RFP	Reclamation Feasibility Plan
RIP	Reclamation Implementation Plan
RPP	Reclamation Program Plan
SCP	Site Characterization Plan
USDA	U.S. Department of Agriculture
YMP	Yucca Mountain Site Characterization Project
YMSCO	Yucca Mountain Site Characterization Office